

MILITARY SPECIFICATION

PLUGS, ELECTRIC, AIRCRAFT STORAGE BATTERY

This specification is mandatory for use by all Departments and Agencies of the Department of Defense.

1. SCOPE

1.1 Items. This specification covers two- and four-wire electric plugs for use on aircraft storage batteries.

1.2 Classification. The plugs are identified by the MS part numbers shown on the applicable standard.

2. APPLICABLE DOCUMENTS

2.1 The following documents of the issue in effect on date of invitation for bids or request for proposal, form a part of this specification to the extent specified herein:

SPECIFICATIONS

Federal

PPP-B-566	Box, Folding, Paperboard
PPP-B-636	Box, Fiberboard
PPP-B-676	Box, Set-up
PPP-T-60	Tape, Pressure-sensitive Adhesive, Waterproof, for Packaging
PPP-T-76	Tape, Pressure-sensitive Adhesive Paper, Water Resistant, (for Carton Sealing)

SPECIFICATIONS (Continued)

Military

MIL-P-116	Preservation, Methods of
MIL-B-117	Bag, Sleeve and Tubing - Interior Packaging
MIL-W-5086/2	Wire, Electric, Hookup and Interconnecting Polyvinyl Chloride Insulation, PVC-Glass-Nylon, Tin-coated Copper Conductor, 600-Volt, 105° C
MIL-E-5272	Environmental Testing, Aeronautical and Associated Equipment, General Specification for
MIL-H-5606	Hydraulic Fluid, Petroleum Base, Aircraft, Missile, and Ordnance
MIL-C-5756	Cable and Wire, Power, Electric, Portable
MIL-S-7742	Screw Threads, Standard, Optimum Selected Series, General Specification for
MIL-L-23699	Lubricating Oil, Aircraft Turbine Engines, Synthetic Base

STANDARDS

Military

MIL-STD-129	Marking for Shipment and Storage
MIL-STD-130	Identification Marking of U.S. Military Property
MS18093	Battery, Storage, Aircraft, Dimensions for
MS20659	Terminal, Lug, Crimp Style, Copper, Uninsulated, Ring Tongue, Type I, Class 1

(Copies of specifications, standards, drawings, and publications required by suppliers in connection with specific procurement functions should be obtained from the procuring activity or as directed by the contracting officer.)

3. REQUIREMENTS

3.1 Qualification. The plugs furnished under this specification shall be products which are approved for listing on the applicable Qualified Products List at the time set for opening of bids (see 4.2 and 6.3).

3.2 Potentials and currents. Unless otherwise specified, all potentials and currents mentioned in this specification are average values.

3.3 Dimensions. The dimensions of each plug shall be as shown on the applicable standard. Where only maximum or minimum dimensions are shown, the plug need not have the shape shown, but the plug, including all protrusions, shall be contained within the outline shown.

3.4 Receptacle. Each plug shall be usable with receptacles conforming to MS18093, and shall meet all requirements of this specification when used with such receptacles. Each plug shall be made so that it can only be installed in the receptacle with the proper polarity.

3.5 Electric connections. Each plug shall include electric connections as follows.

3.5.1 Two-wire plugs. Each two-wire plug shall include as its electric connections two sockets with their axes vertical and in a plane parallel to the face of the receptacle. Each plug shall be usable with two wires conforming to MIL-W-5086/2 for Type 2 and size 000. Each plug shall include two wire entry holes on the bottom, through which the wires may be brought into the sockets. Each plug shall be made so that the wires shall enter it vertically and in a plane parallel to the face of the receptacle. Each plug shall be made so that the wire which enters the left wire entry hole, as viewed looking at the front (handle) face of the plug, can be connected to the negative contact only, and the wire which enters the right wire entry hole can be connected to the positive contact only. "-" and "+" shall be marked on the front, back, bottom, or sides of the plug so as to identify the wires connected to the plug. The plug shall be made so that it is not possible to assemble it with any of the marking not in its proper location. Each plug shall include two setscrews for retaining the wires in the sockets. The axes of the setscrews shall be perpendicular to the face of the receptacle. Each setscrew shall include a hexagonal wrenching socket. Each plug shall include two wrench entry holes on the front face, and shall be made so that the setscrews can be operated by a wrench inserted in the wrench entry holes. No part of the electric circuit of the plug shall be exposed except through the wire, wrench, and contact entry holes.

3.5.2 Four-wire plugs. Each four-wire plug shall include as its electric connections two posts or holes having threads conforming to MIL-S-7742 for 5/16-inch nominal size. The posts or holes shall be on the vertical centerline of the

plug. Each plug shall have two wire entry holes on each end. The plug shall be usable with two wires conforming to MIL-W-5086/2 for Type 2, and also with two wires conforming to MIL-C-5756, of any size up to and including 000, with suitable terminal lugs conforming to MS20659 installed on them. The upper holes shall accommodate the wire connected to the positive contact, and the lower holes shall accommodate the wire connected to the negative contact. The plug shall be made so that the wires will enter it in a horizontal direction and parallel to the face of the receptacle. The plug shall be made so that the wire connected to the positive contact can be installed in either upper hole, and the wire connected to the negative contact can be installed in either lower hole. The plug shall also be usable with four wires as described above with terminal lugs as described above installed on them, with a wire connected to the positive contact installed in the upper wire entry hole on each end of the plug, and a wire connected to the negative contact installed in the lower wire entry hole on each end of the plug. "+" and "-" shall be marked on each end of the front of the plug so as to identify the wires entering the holes. Each plug shall include nuts or screws, washers, etc., as necessary to install the terminal lugs on its electric connections. "+" and "-" shall be marked on the inside of the plug so as to identify the electric connections while the lugs are being installed on them. The plug shall be made so that it is not possible to assemble it with any of the marking not in its proper location. No part of the electric circuit of the plug shall be exposed except through the wire and contact entry holes.

3.6 Mechanical operation. Each plug shall be operable as follows:

3.6.1 Two-wire plugs. Each two-wire plug shall include a handle. Each plug shall be made so that rotating the handle a maximum of 275 degrees clockwise, as viewed looking at the front (handle) face of the plug, will engage the plug with the receptacle, and rotating the handle a maximum of 275 degrees counterclockwise will disengage the plug from the receptacle. The handle shall be within 5 degrees of the horizontal when the plug is fully engaged with the receptacle. The torque required to engage the plug with the receptacle and disengage it from the receptacle shall not exceed 12.5 inch-pounds at any point. It shall not be necessary to apply any force to the plug to effect engagement or disengagement. Each plug shall include means which will retain the plug in the receptacle, and which shall be automatic and completely self-contained and built into the plug.

3.6.2 Four-wire plugs. Each four-wire plug shall include a handwheel marked "REMOVE", with an arrow, in two places. The plug shall be made so that rotating the handwheel a maximum of 275 degrees in the opposite of the direction marked "REMOVE" will engage the plug with the receptacle, and rotating the handwheel a maximum of 275 degrees in the direction marked "REMOVE" will remove the plug from the receptacle. The "REMOVE" marking on the handwheel shall be within 5 degrees of the horizontal when the plug is fully engaged. The torque required to engage the plug with the receptacle and remove it from the receptacle shall not

exceed 7.5 inch-pounds at any point. It shall not be necessary to apply any force to the plug to effect engagement or disengagement. Each plug shall include means which will retain the plug in the receptacle, and which shall be automatic and completely self-contained and built into the plug.

3.7 Maximum weight. The weight of each two-wire plug shall not exceed 0.65 pound. The weight of each four-wire plug shall not exceed 1.3 pounds.

3.8 Identification marking. Parts, subassemblies, and plugs shall be marked for identification in accordance with MIL-STD-130.

3.9 Suitability for use. The plugs shall be capable of passing the tests of Section 4.

4. QUALITY ASSURANCE PROVISIONS

4.1 Responsibility for inspection. Unless otherwise specified in the contract or purchase order, the supplier is responsible for the performance of all inspection requirements as specified herein. Except as otherwise specified in the contract or order, the supplier may use his own or any other facilities suitable for the performance of the inspection requirements specified herein, unless disapproved by the Government. The Government reserves the right to perform any of the inspections set forth in the specification where such inspections are deemed necessary to assure supplies and services conform to prescribed requirements.

4.2 Qualification testing. A sample of plugs to be tested for qualification to be offered on a bid shall consist of one, or, at the option of the manufacturer, more than one, plug of a given manufacturer's part number. The plug(s) shall be subjected to the tests of 4.6.1 through 4.6.25, except 4.6.21. If the manufacturer becomes qualified, the sample plug on the testing of which his qualification is based will be retained at the Government agency which does the testing as long as he is qualified, and if he receives a contract to furnish such plugs to the Government, the sample plug will be disassembled and dissected to determine that the plugs being furnished under the contract are identical to it.

4.3 Contract testing. Plugs produced under a contract shall be tested as follows.

4.3.1 Plugs for testing by the Government. The manufacturer shall furnish the number of plugs required by 4.3.2.3 in addition to the number of plugs being procured under the contract. The plugs which are tested in accordance with this paragraph will not be delivered under the contract. The manufacturer need not perform any testing on these plugs.

4.3.2 Acceptance testing. Plugs offered for acceptance under a contract shall be tested as follows.

4.3.2.1 Individual tests. Each plug shall be subjected to the tests of 4.6.1 through 4.6.3.

4.3.2.2 Preparation for delivery. Sample items and packs shall be selected and inspected in accordance with MIL-P-116 Table III, including the rough handling test, to verify conformance to Section 5.

4.3.2.3 Sampling tests. One plug shall be selected at random by the Government inspector from each group of 10 plugs, or remaining group of 5 to 100 plugs, produced under the contract (representing 100 plugs, or remaining group of 50 to 99 plugs, to be delivered under the contract), but with a minimum of one plug being selected. These plugs shall be sent to the Government testing agency specified in the contract, where they will be subjected to the tests of 4.6.1 through 4.6.21. Acceptance of each group of plugs will be withheld until the sample representing the group has passed the tests. If the contract consists of a firm quantity and one or more optional quantities, samples shall be selected from the firm quantity and each optional quantity individually as specified above, except that the minimum of one plug shall apply only to the total number of plugs procured under the contract.

4.4 Rejection and resubmission. When a plug fails an individual test, the manufacturer may, at his option, rework it and resubmit it, or submit a new plug in place of it. A plug which has been reworked and resubmitted may, at the discretion of the inspector, be subjected to any tests of this specification beside those which it had not passed before it was reworked.

4.5 Test conditions. All tests of this specification shall be performed in the following conditions unless otherwise specified in the description of the test.

4.5.1 Receptacle. Whenever the plug must be engaged with a receptacle, it shall be engaged with a receptacle conforming to MS18093.

4.5.2 Electric connection. Whenever electric connection must be made to the plug, two wire conforming to MIL-W-5086/2 for Type 2, of the largest size called out in 3.5 for such wires, shall be connected to the plug in accordance with 3.5.

4.5.3 Temperature. The ambient temperature, and the initial temperature of the plug, shall be 70 ± 10 F. When a temperature other than 70 F is specified, the plug shall be kept in a chamber maintained at the specified temperature, ± 5 F, for 12.0 ± 0.5 hours, and then, while remaining in the chamber maintained at the specified temperature, shall be subjected to the test. If a receptacle is required for the test, the receptacle shall also be kept in the chamber for the 12-hour period and for the test.

4.5.4 Attitude. The plug shall be in the attitude in which it is shown on the applicable standard. The receptacle shall be in the attitude in which it is shown on MS18093.

4.5.5 Times. All times shall be within ± 5 percent of the specified value.

4.5.6 "Evaluation of equipment" test. The plug shall be subjected to the test of 4.6.8 as the test for "Evaluation of equipment" for all tests of MIL-E-5272.

4.5.7 Order of tests. The tests on each plug shall be performed in the order in which they appear in this specification.

4.6 Tests.

4.6.1 Dimensions. Each plug shall be measured for conformance to 3.3. Measurements performed during manufacture are acceptable in fulfillment of this requirement.

4.6.2 Mechanical operation. Each plug shall be engaged with and disengaged from a receptacle.

4.6.3 Examination. Each plug shall be examined to determine compliance with all requirements of this specification for which there are no specific tests.

4.6.4 Maximum weight. The plug shall be weighed for conformance to 3.7.

4.6.5 Dielectric strength. A potential having an effective value of 2,500 ± 500 volts and any frequency between 0 and 600 Hz, or dc, shall be applied between the electric connections of the plug for 1 minute. There shall not be any breakdown of insulation.

4.6.6 Insulation resistance. The insulation resistance of the plug shall be measured by applying a potential having an effective value of 500 ± 100 volts and any frequency between 0 and 600 Hz, or dc, between the electric connections of the plug for 1 minute. The resistance shall be at least 5 gigohms.

4.6.7 Operating torque. The plug shall be engaged with and disengaged from a receptacle having contact pins with diameters within 0.002 inch of (but not greater than) the maximum diameter permitted by MS18093. The operating torque shall be measured to determine conformance to the operating torque requirement of 3.6.

4.6.8 Contact resistance. The plug shall be engaged with a receptacle having contact pins with diameters within 0.002 inch of (but not less than) the minimum diameter permitted by MS18093, with the pins connected together by a copper shorting bar having a cross-sectional area at all points at least equal to that of the pins. A current of $1,200 \pm 25$ amperes shall be passed through the plug and receptacle by means of the wires connected to the plug for 1 minute. The potential shall be measured between each wire connected to the plug, by means of a needle contact piercing the insulation of the wire and contacting the conductors of the wire at a point just before the wire enters the plug, and the back end of the corresponding pin of the receptacle, by means of a connection directly to the pin and not to the shorting bar. Neither potential shall exceed 88 millivolts at any time. The plug shall then be left idle (no current flowing through it) for 1.0 ± 0.1 hour. A current of 750 ± 15 amperes shall then be passed through the plug and receptacle for 5 minutes, and neither potential measured as described above shall exceed 55 millivolts at any time.

4.6.9 Dielectric strength at -65 F. The plug shall be subjected to the test of 4.6.5 at -65F.

4.6.10 Insulation resistance at -65 F. The plug shall be subjected to the test of 4.6.6 at -65 F.

4.6.11 Operating torque at -65 F. The plug shall be subjected to the test of 4.6.7 at -65 F.

4.6.12 Contact resistance at -65 F. The plug shall be subjected to the test of 4.6.8 at -65 F.

4.6.13 Dielectric strength at 160 F. The plug shall be subjected to the test of 4.6.5 at 160 F.

4.6.14 Insulation resistance at 160 F. The plug shall be subjected to the test of 4.6.6 at 160 F except that the minimum resistance shall be 300 megohms instead of 5 gigohms.

4.6.15 Operating torque at 160 F. The plug shall be subjected to the test of 4.6.7 at 160 F.

4.6.16 Contact resistance at 160 F. The plug shall be subjected to the test of 4.6.8 at 160 F.

4.6.17 Life. The plug shall be engaged with and disengaged from a receptacle 5,000 times at a rate of 10 ± 1 cycles per minute. The plug shall then be subjected to the tests of 4.6.7 and 4.6.8.

4.6.18 Mechanical shock. The plug shall be subjected to the shock test Procedure V of MIL-E-5272 except that the shocks with the plug inverted shall be omitted. The plug shall be engaged with a receptacle. Electric connection shall be made to the plug, and the wires shall be supported at a point 1.0 ± 0.1 foot below and 1.0 ± 0.1 foot to the side of the axis of the handle or handwheel of the plug. The shocks shall be applied to the receptacle, and the plug shall be supported by the receptacle only. No resilient mounting shall be provided. The plug shall then be subjected to the test of 4.6.8.

4.6.19 Temperature shock. The plug shall be subjected to the temperature shock test Procedure I of MIL-E-5272. The plug shall then be subjected to the test of 4.6.5 instead of the test of 4.6.8.

4.6.20 Vibration. The plug shall be subjected to the vibration test Procedure XII of MIL-E-5272. The plug shall be engaged with a receptacle. Electric connection shall be made to the plug, and the wires shall be supported at a point 1.0 ± 0.1 foot below and 1.0 ± 0.1 foot to the side of the axis of the handle or handwheel of the plug. The vibration shall be applied to the receptacle, and the plug shall be supported by the receptacle only.

4.6.21 Comparison with qualification sample. The plug shall be disassembled and dissected to determine that it is identical to the sample plug on the testing of which qualification is based.

4.6.22 Fungus. The plug shall be subjected to the fungus test Procedure I of MIL-E-5272.

4.6.23 Humidity. The plug shall be subjected to the humidity test Procedure I of MIL-E-5272.

4.6.24 Immersion. The plug shall be immersed in each of the liquids below in turn for the length of time listed below:

- (a) MIL-H-5606 Aircraft hydraulic liquid - 20 hours
- (b) MIL-L-23699 Aircraft Engine lubricating oil - 20 hours
- (c) Sulfuric acid (H_2SO_4) of specific gravity 1.1 - 4 hours
- (d) Potassium hydroxide (KOH) of specific gravity 1.1 - 4 hours

The plug shall then be washed and dried, and shall then be subjected to the tests of 4.6.5 through 4.6.8.

4.6.25 Salt spray. The plug shall be subjected to the salt spray test Procedure I of MIL-E-5272.

5. PREPARATION FOR DELIVERY

5.1 Preservation and packaging. Preservation and packaging shall be level A or C, as specified (see 6.2).

5.1.1 Level A.

5.1.1.1 Cleaning. Plugs shall be cleaned in accordance with process C-1 of MIL-P-116.

5.1.1.2 Drying. The procedure(s) used shall not be injurious to the plug.

5.1.1.3 Preservation application. No preservation is required.

5.1.1.4 Unit packaging. Plugs shall be individually packaged, Method 1C-1, in accordance with MIL-P-116, as follows: Cushion the plug on all surfaces in accordance with paragraph in Section 3 titled "General" under paragraph titled "Methods of preservation (unit protection)" and paragraph titled "Physical protection" of MIL-P-116. Insert the cushioned plug within a close fitting bag fabricated in accordance with MIL-B-117, Type II, Class C, heat seal closure.

5.1.1.5 Intermediate packaging. Plugs packaged as specified in 5.1.1.4 shall be placed in intermediate containers conforming to PPP-B-566 or PPP-B-676. Intermediate containers shall be uniform in size and shape, shall be of minimum cube and tare, and shall contain multiples of 5 unit packages not to exceed 100 packages or 10 pounds. No intermediate packaging is required when the total quantity shipped to a single destination is less than 100 units, or less than 2 intermediate packages.

5.1.2 Level C. Plugs shall be preserved and packaged in a manner that will afford protection against corrosion, deterioration, and physical damage from the supply source to the first receiving activity for immediate use. The package may conform to the supplier's commercial practice for retail distribution when such meets the requirements of this level.

5.2 Packing. Packing shall be Level A, B or C, as specified (see 6.2).

5.2.1 Level A. The packaged plugs shall be packed in fiberboard containers conforming to PPP-B-636, Class, weather resistant, style optional, special requirements. In lieu of the closure and waterproof requirements in the appendix of PPP-B-636, closures and waterproofing shall be accomplished by sealing the center seams, edges, ends, and manufacturers joints with 2-inch-wide tape conforming to PPP-T-60 or PPP-T-76. Banding (reinforcement requirement) shall be applied in accordance with the appendix to PPP-B-636. Metal banding shall not be used.

5.2.2 Level B. The packaged plugs shall be packed in fiberboard boxes conforming to PPP-B-636, class domestic. Closure shall be in accordance with Method II in the appendix to PPP-B-636.

5.2.3 Level C. The packaged plugs shall be packed in a manner that will afford adequate protection against damage during direct shipment from the supply source to the first receiving activity for immediate use. This pack shall conform to the applicable carrier rules and regulations and may be the supplier's commercial practice when such conforms to the requirements of this level.

5.3 Marking. In addition to any special marking required by the contract or order, each unit package, intermediate package, and shipping container shall be marked in accordance with MIL-STD-129.

5.4 General. Exterior containers shall be a minimum tare and cube consistent with the protection required and shall contain equal quantities of identical items to the greatest extent possible.

6. NOTES

6.1 Intended use. The plugs covered by this specification are intended for use in aircraft for making electric connection to storage batteries, and also for use in shops for making electric connection to the batteries while they are being charged and discharged.

6.2 Ordering data. Procurement documents should specify the following:

- (a) Title, number (including the revision letter), and date of this specification.
- (b) The MS part number of the plug which is desired.
- (c) The number (including the revision letter, if any), date, and title of the procurement standard (all of the latest revision, if any).
- (d) Levels of packaging and packing required (See Section 5).
- (e) The name and address of the Government testing agency to which the samples are to be sent.

6.3 Qualification. With respect to products requiring qualification, awards will be made only for products which are at the time set for opening of bids, qualified for inclusion in the applicable Qualified Products List whether or not such products have actually been so listed by that date. The attention of the suppliers is called to this requirement, and manufacturers are urged to arrange to have the products that they propose to offer to the Federal Government tested for qualification in order that they may be eligible to be awarded contracts or orders for the products covered by this specification. The activity responsible for the Qualified Products List is Naval Air Systems Command, Department of the Navy, Attn: AIR-5368, Washington, D. C. 20360, and information pertaining to qualification of products may be obtained from that activity.

6.4 International standardization - "Certain provisions of this specification are the subject of international standardization agreement (ASCC AIR STANDARD 12/18 and STANAG 3660 AE). When **amendment, revision or cancellation** of this specification is proposed which will effect or violate the international agreement concerned, the preparing activity will take appropriate reconciliation action through international standardization channels, including departmental standardization offices, if required."

Custodians.

Navy - AS
Air Force - 80
Army - Av

Preparing Activity:
Navy - AS
Project No. 5935-1711

Reviewer Activities:

Navy - AS
Air Force - 11, 80
Army - AV